AQUASTRESS

Mitigation of Water Stress through new Approaches to Integrating Management, Technical, Economic and Institutional Instruments

Integrated Project

D5.3-5 & D5.4-5 UNIFIED DELIVERABLE

OVERVIEW ON IMPLEMENTED VIRTUAL AND REAL TESTS - CONTRIBUTION TO FINAL TEST & EVALUATION REPORT (M44)

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Abstract

This deliverable outlines the different virtual and real tests which have been carried out during the AquaStress project. It first classifies the different types of water stress mitigation options that have been tested, gives some idea of their purpose, and stresses the types of water uses on which they focus. It shows next the way these options have been tested, in terms of field implementation, stakeholder involvement, as well as risk of test damage. It finally gives an idea of which evaluation criteria were used to evaluate mitigation options' relevance in the different test sites. This report relies on a

questionnaire that has been filled in by the respective project partners who were responsible for option testing and evaluation.

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Introduction

This report provides an overview on the various virtual and real tests that have been carried out in the AquaStress project. By doing so it also presents and classifies the various water stress mitigation options that have been tested and evaluated in the project and as far as they have been indicated by project partners for the purposes of this report.

Water stress mitigation options are seen here as measures that are proposed with the objective to reduce water stress. A typical such measure – or option – would be for example the introduction of a new water saving technology such as drip irrigation. The option thus includes all aspects that are necessary for a successful adoption of the drip irrigation technology – including its local acceptance, an adequate infrastructure in place (e.g. enough water pressure to make the drip irrigation system work) and the local know-how to use it properly.

The example shows that an option is more than a tool. In the example the drip irrigation technology would be one of the tools but everything that is required to actually make the technology work – plus the technology itself - locally would be the option. Tools have also been produced by the AquaStress project. In and by themselves they do nothing to reduce water stress. To do this they have to be integrated into an option. Examples for tools are multicriteria decision analysis tools, remote sensing devices, role games that allow users to virtually test an option and many others.

This report shows how options in AquaStress have been tested virtually and also in real settings. Considering the technological, economic, environmental, and social complexities that affect the introduction of a water stress mitigation option, this report also provides an overview on which of these criteria were taken into account for the testing of the various options.

The next section will explain how this was done. Afterwards the results are presented in a summarized form (complete results are shown in Annex 1).

Methodology

The process

Early 2007, the AquaStress partners filled in a questionnaire for each activity they were involved in. This work was done in order to have an overview of which tests were planned where, why and how. This work ended up with the writing of a specific deliverable[1]. It stressed all the activities using the same framework based on the overall AquaStress problem solving process (option definition, option testing and option evaluation).

One and a half year later, before the end of the project, we needed to assess what was done and evaluate the results. The objective was not for us to evaluate the relevance of a specific mitigation option in a specific context because this is under the responsibility of the different partners who proposed options in the test sites. Our objective was rather to compare and evaluate, at the project

[1] Deliverable 5.2-5 (Mid-term T&E report)

level, the wide range of methodologies and tools used to test water stress mitigation option, especially in terms of level of field implementation, stakeholder involvement and evaluation criteria.

A new questionnaire was sent among partners, together with a guideline on how to fill in the table, an example, and a contact.

The questions

Basically, the questionnaire aims to answers four main questions:

1. What is the option about and which are the objectives of the test?
2. How did you manage to test the option?
3. What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?
4. What are the main results of this test regarding water stress mitigation?

Each question is divided into other sub-questions, some being quantitative (from 0 to 5) and qualitative, other being qualitative only. In the next paragraphs, the different sub-sections are presented together with an explanation in italic.

1. What is the option about and which are the objectives of the test?

    a. Test site

Where the option is being tested?

    b. Purpose of the option

What is the purpose of the mitigation proposed?

    c. Object of test

Integrated innovative technology
Integrated innovative technologies are though as physical artefact (a water conserving device, for example) going with an innovation process which is integrated within a wider system. Consequently, testing an innovative technology that is to be introduced in a complex system should not only focus on its physical consequences. Specific attention should also be paid to which inputs are needed to apply it, how the technology will be used, and which side effects it may produce in time and space and at different system levels.

Economic mechanisms
Economic mechanisms or economic instruments have the potential to alter water consumption patterns as to promote efficiency in water use. The economic mechanisms that may be applied include consumption quotas, water pricing, consumption taxes, pollution taxes, and permit systems. These mechanisms are developed and tested using economic models. These models are usually based on the assumption of rationality on behalf of water users and complete information on all parameters of the problem by all actors involved. When these conditions are not met (which is often the case), the models will not adequately predict actor behaviour. In such situations, practical field tests can help to assess the impact of the economic mechanism on individual and aggregate welfare as well as its effectiveness in coping with water stress. Field testing economic mechanisms is difficult because their implementation requires institutional changes that entail legislative changes.

Procedural methods

The third type of mitigation options studied in the AquaStress project is the introduction of an innovative procedure to improve decision making for planning or management. In complex socio-economic environments, there is no single "best" management mode, but rather a range of management modes that respond more or less effectively to different vested interests. Based on this observation, new procedures can be developed in order to reconcile divergent interests, find agreement between stakeholders, and improve the quality of decision-making. Procedural options are even more difficult to test than economic mechanisms because they involve institutional and political change, while pertinent theories are partial and value-laden.

d. Objective of the test

The mitigation options to be tested in the AquaStress project are proposed by experts. Testing the options gives the experts and other associated stakeholders the possibility to state at the end of the test why, and to what degree, the option is appropriate for a specific context, effective, efficient, and so on. The rationale behind option testing is that it will reduce the risk of implementing a mitigation option that is not appropriate for a specific context. A test should therefore provide relevant information about, for example, the technical feasibility, the economic viability, the social acceptability, as well as the environmental sustainability, of mitigation options. Comprehensive testing is needed because a mitigation option that is technically feasible may be socially unacceptable. Such testing requires that the mitigation option is tried out or otherwise assessed by its potential users and the people who will be impacted by it, in order to determine its various consequences. If these consequences do not meet certain explicit evaluation criteria, the option should be rejected or modified.

2. How did you manage to test the option?

a. Level of field implementation (0-5)

A mitigation option can be tested either virtually or in a real-world situation. A "virtual" test means that the mitigation option is placed in a controlled situation that reproduces the characteristics, components and dynamics of the real system in which the option could be implemented. Because these systems are complex, the controlled situation should consider social, environmental as well as economic, factors. Virtual tests usually involve the use models, but can also involve people, in particular for estimating the social consequences of an option.

A "real-world" test means implementing the option in the real system, but on a small scale (in space or time) only (or it would not be a test). A "real-world" test may cause real damage, as the impacts of the option are real, not simulated. On the other had, there will be less chances that unforeseen but important system impacts are overlooked, whereas such impacts may be ignored in "virtual" tests because simulation models are always incomplete representations of reality.

In the same water problem solving process, an option can be tested both virtually and in the real world. For a more in-depth elaboration of the notions of "virtual" and of "real-world" test, see MacKenzie et al. (1999), Pinch, (1993) or Bijker (1995).

b. Level of user involvement (0-5)

The involvement of users or stakeholders in a testing process can be done at different phases and with different intensity. Firstly, they may not be involved at all, or just informed about the test. Secondly, they could be consulted to hear their points of view. For example, they could provide information on constraints, needs and possible interests they have relative to the option during different participatory activities. However, in this case there is no guarantee that this information received will change the test. Finally, they can be actively involved in the testing process, working collaboratively with the implementers. In this case, the users or stakeholders take part in the experiment with the option, virtually or in the real-world, provide and exchange knowledge and take part in the decision-making processes throughout the test.

For more elaborate descriptions on types of participation with different stakeholders and throughout the different stages of the option testing process, see Arnstein (1969), Pateman (1970), Fischer (1990), Rocha (1997), Mostert (2003), Thomas (2004), Daniell et al. (2006) and Mazri (2007).

c. External factors consideration (0-5)

The output of the test of an option into a specific context may result from the test itself, but can also result from non-controlled exogenous factors. Indeed, when designing and implementing a test, specific attention should be paid to any exogenous factors which might influence the results of the test.

In complex systems, the linkages between external factors and the observed results are difficult to establish. If such knowledge is lacking for the test site, a reference system or model may be used as standard for comparison. If no such standard is available, other methodological designs that systematically take into account the influence of external factors (e.g., experimental or quasi-experimental designs, see Mohr (1995) and Borland et al. (2004) for more information) may be used. However, such designs are complicated and expensive to implement, and often even practically unfeasible because it is impossible to replicate the test under different circumstances (Hohler et al., 2002).

d. Risk of test damage (0-5)

Testing a mitigation option may jeopardise the current "real-world" system under water stress. For example, a "real-world" test of injecting treated waste water might cause a local deterioration of the quality of the groundwater. Likewise, a "virtual" test of a water rights trading system that involves stakeholders might antagonise certain stakeholders and hamper future negotiations. Therefore, when designing a test, the likelihood of producing negative consequences on the system as a result of the test should be estimated.

The degree of risk that a test poses to the system under consideration can be more or less rigorously analysed against a variety of criteria using formalised methods of "risk analysis". The following publications can be referred to for more information: ISO/IEC (2002), Standards Australia (2004), Renn (2006), Mazri (2007).

3. What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?

When evaluating an option, several criteria from each of these sub-categories should be chosen to ensure comprehensive testing.

- ***Technical:*** *Feasibility (i.e. of option design, installation and maintenance), changes to existing infrastructure and technologies-in-use (0-5)*
- ***Environmental:*** *Ecosystem health and biodiversity, carbon and nutrient balances, waste production (0-5)*
- ***Economic:*** *Viability, efficiency, changes in micro and macro economic factors (0-5)*
- ***Social:*** *Health, well-being, equity, governance, participation, acceptability (0-5)*

4. What are the main results of this test regarding water stress mitigation?

    a. How do you assess the relevance of your option in this context? (0-5)

    b. Which are the main positive points

    c. Which are the main negative points?

    d. Which lessons are relevant regarding UE level?

The data treatment

The quantitative data gathered were synthesized in graphs presented in the result chapter. From the first questions, the type of water uses linked to the option proposed was assessed. The purposes of the options were also speculated. Based on the answers, three main classes were specified: strategic management, operational management and capacity building.

Limitations:

It needs to be reemphasized that this report is based on the answers of project partners who independently filled in the provided questionnaires. Except for the explanations contained in the questionnaires and the guide, there was no further clarification of questions. This means that certain questions, or terminology, may have been interpreted in different ways by different partners. For example some partners may have confused “option” and “tool”. Also the 0-5 (low-high) scale in the questionnaire provided considerable subjective leeway with regard to the answers that partners could provide. However, some work was done to ensure the logic of the answers, and improve their validity. Thus, the picture drawn by the various results represented here is – if not 100 percent accurate of course – certainly a valid indication into how AquaStress partners perceive how mitigation options have been tested and evaluated within the project.

In addition it needs to be pointed out that the options discussed here do not represent all options that were tested in AquaStress as not all researchers returned the questionnaires. Considering that about half of the options were not captured here, this report only shows a reasonable overview of the variety of AquaStress options that were tested.

The comparison and deep analyse of the results produced will be further achieved within WB2 for the final T & E report of the AquaStress project. This is especially the case regarding the treatment of the last part of the questionnaire which focuses on the results of the test, more than on the processes.

Summary of Results

21 questionnaires were filled in and sent back, out of the 21 activities of the project linked to a specific mitigation option.

The water stress mitigation options

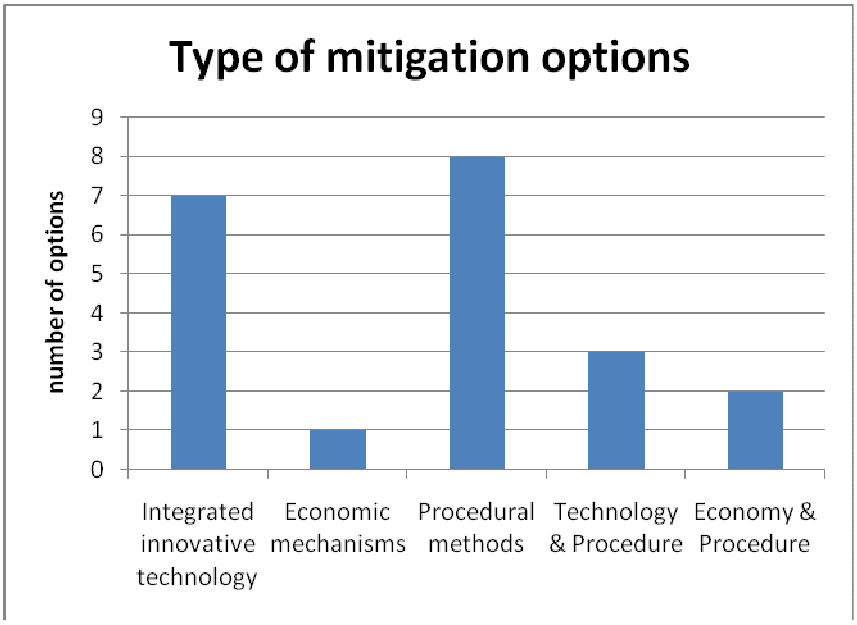

Figure 1 = Different types of options tested in the project.

The three main types of options have been tested in the AQS project, as well as some combinations of these options (e.g. a technology associated with a procedure). As seen in figure 1, procedural methods and integrated innovative technologies were the most commons, these included tools for strategic management (see figure 3).

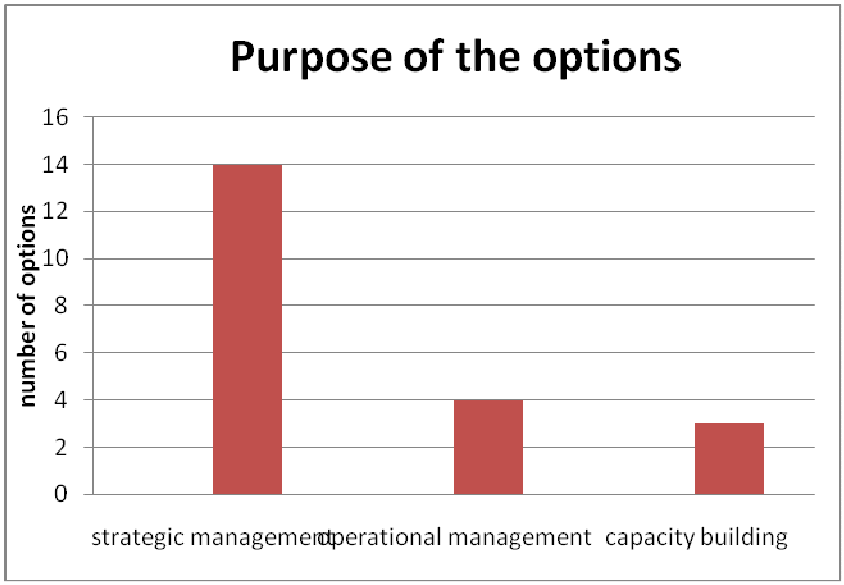

Figure 2 Purpose of the options tested in the AquaStress project.

Most of the options aimed to improve strategic management of water, at a very high level of decision-making such as water boards, state agencies, irrigation schemes management agencies..., that is to say with institutions that defines strategic decisions like policies. A few options aimed to improve operational management, at a lower decision-making level, mostly with end-users such as farmers, dam operator or industries. Finally some options aimed to improve water management by improving stakeholder capacity on various topics such as negotiation, or to gender aspects consideration.

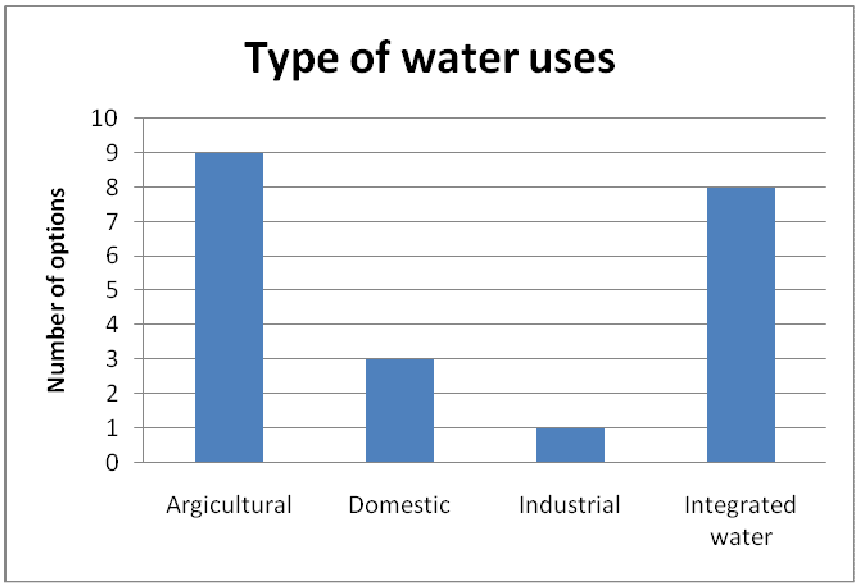

Figure 3 Types of water uses on which the mitigation focus.

Most of the mitigation options tested in the project target water which is used for agriculture, as well as water which is used for multi purposes. A few options target domestic water and Industrial water.

Modality of testing

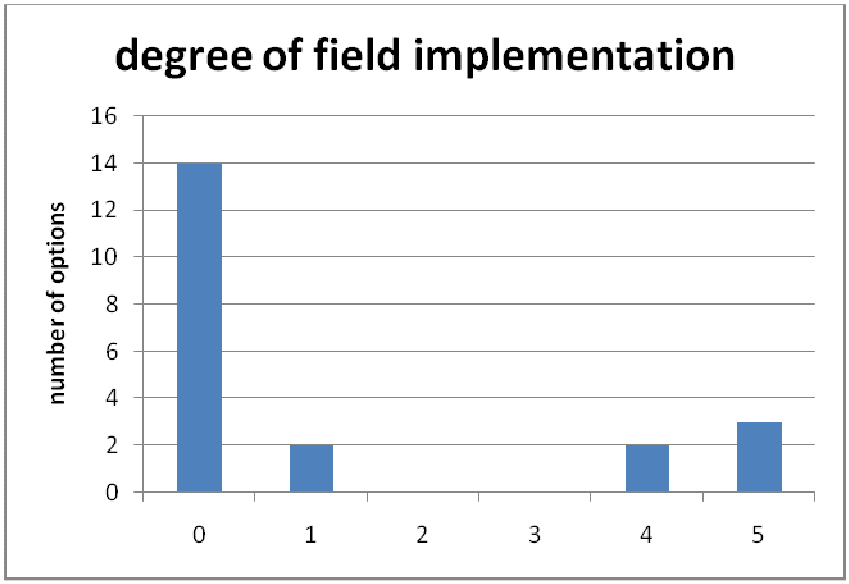

Figure 4 Degree of field implementation of the tests from 0 = virtual test to 5 = real field test

As seen in figure 4, most of the testing activities achieved in the AQS project are virtual (16/21). This means that options have been placed in controlled situations that reproduce the characteristics, components and dynamics of the real systems in which the options could be implemented. Most of these virtual tests have been done through running simulation on models, using existing data or data gathered during field surveys. Some other tools such as scenario development and exploration or role-playing games have also being used.

A few "real-world" tests have been achieved (5/21). This means that some options have been implemented in the real system, in the field, but on a small scale (in space or time) only (or it would not be a test). These tests were related to operational management options with end-users such as farmers or capacity building options.

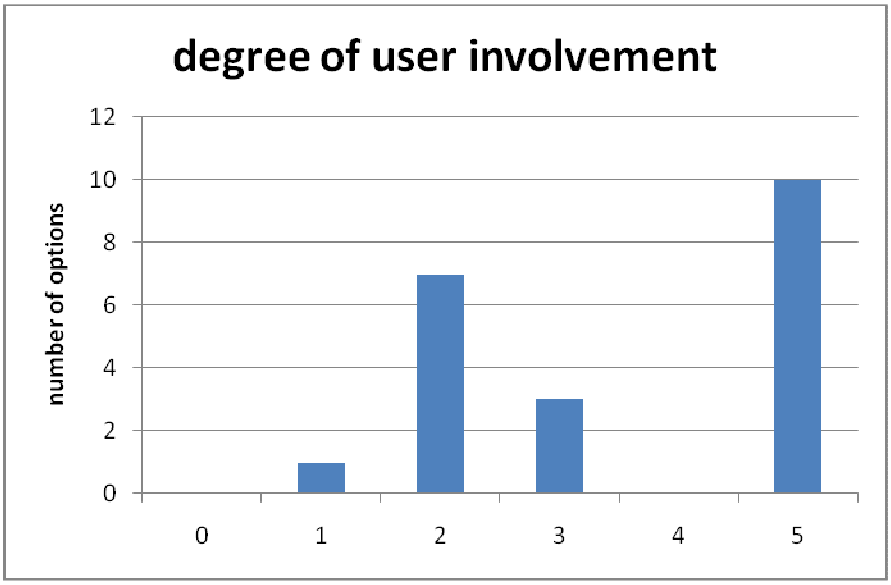

Figure 5 Degree of user involvement from 0 = none to 5 = high.

According to the received responses, stakeholder involvement was high for half of the options, and medium for the rest. A specific report (D 5.1-6) focuses on this question.

Finally, in 90% of the cases, the risk of test damage was considered weak, mainly because they remained virtual.

Option evaluation criteria

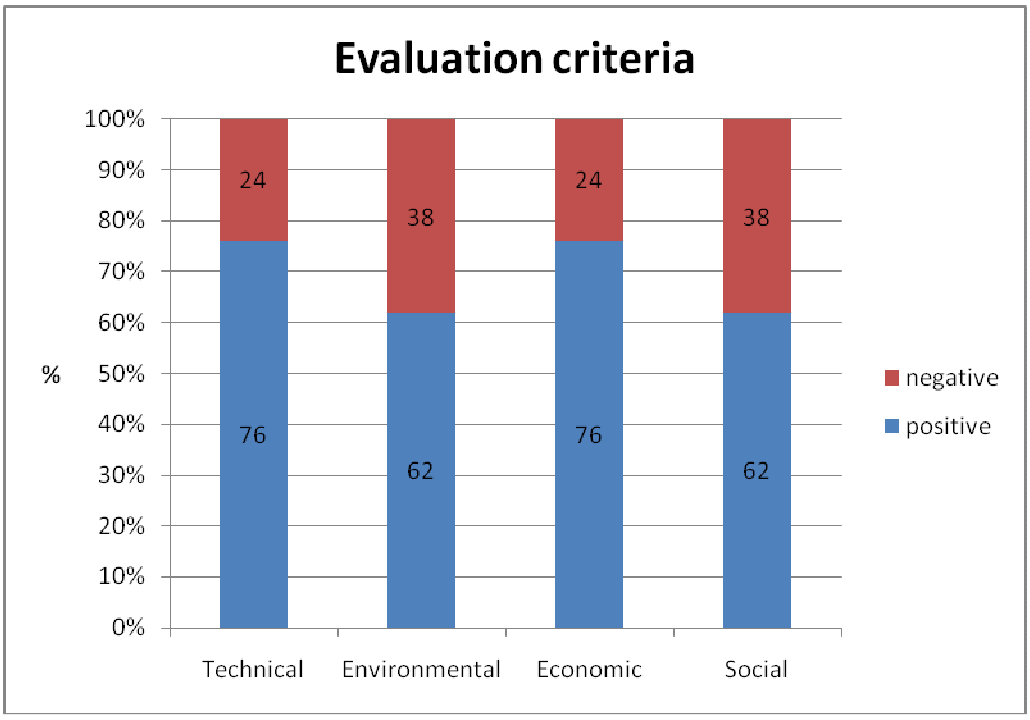

Figure 6 Average of positive and negative answers for different types of evaluation criteria used to test the options.

As seen in figure 6, and according to the partners' perception, 76% of the tests have taken into account technical considerations, 62% environmental considerations, 76% economical consideration and 62 % social considerations. For some options, some evaluation criteria were not relevant. For instance, according to the answers provided, technical criteria are not relevant regarding the test of an economical option such as water pricing (figure 7). In some other cases, tests have only partially been achieved, which is linked to the fact that some options have not been confronted to the field (figure 4).

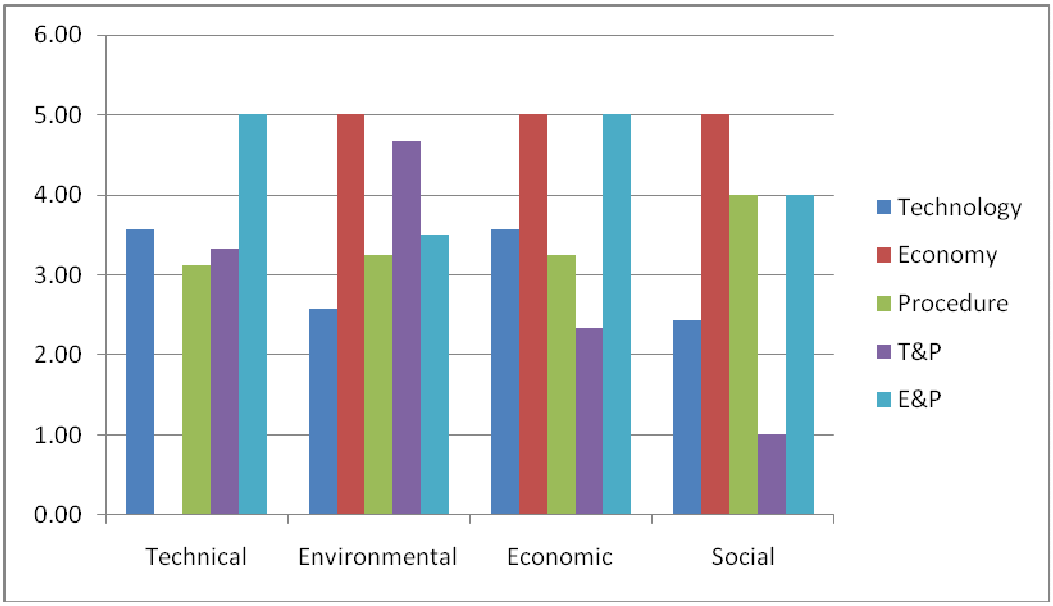

Figure 7 Relative importance (from 0 = not important at all to 5 = very important) of the different evaluation criteria (horizontal axis) for the 5 classes of mitigation options.

Annex I: T & E results reporting framework tables

Guadiana Case Study

Name of the option		Welfare effects / Political economy of water pricing
Test site		Guadiana (Portugal)
Purpose of the option		To find out farmers' preferences for water pricing policy and therefore provide evidence and reference for designing such policy
Object of test*		Choice Experiment
Objective of the test		Estimation of the price elasticity of irrigation water demand; Understanding of farmers' preferences for water supply policy; Simulation of policy alternatives for water pricing schemes and the effect on water resource use and crop structure change.
How did you manage to test the option?		
Modality or testing	Methods and tools	Surveys, farmer to farmer visits, statistical analysis of the surveys; simulation
	Level of field implementation (0-5)	0 : The option is a virtual test that allows policy makers to have a better understanding of farmers' preferences
	Level of users/stakeholders involvement (0-5)	5: Local institutional partners as well as farmers have been involved
	Risk of test damage (0-5)	0: Short term increase of some costs due to water pricing, and have different impact on different income groups (in case of real test)
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	0 : NA
	Environmental (0-5)	0 : If the option is implemented, environmental impacts have to be assessed to monitor the total water use quantity and seasonal distribution
	Economic (0-5)	5 : cost recovery of the water supply service, and the impact on the production activity, therefore income of the local farmers
	Social (0-5)	5 : Surveys and collective discussion were performed with the farmers to assess the social acceptability of such an option. Special attention should be given to the different impacts on different income groups.
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5 : Water demand elasticity is most relevant in designing water pricing policy. Choice experiment is an excellent tool that enables policy makers to elicit preferences of individuals who might be subject to a particular water policy. It allows them to design policies that might be more socially acceptable.
Which are the main positive points		Water price elasticity in the test site is -0.45, which is in a reasonable region. Most farmers are willing to use the surface water supply and accept the water pricing policy under reasonable conditions. Price is the first important factors for farmers; 10cents/m^3 is acceptable to most farmers for water with pressure. Farmers generally don't care much about water quality.
Which are the main negative points?		This remains a virtual test. Only implementation of such policy may allow us to ultimately validate this option.

Which lessons are relevant regarding UE level?	This study provides reference for the stakeholders to design water pricing policy taking account of farmers' preferences, especially on water pressure, and reliability. In addition, it involves the different acceptability by different income groups, and therefore provides reference for designing different water tariff.

Name of the option		Best Olive Irrigation Practices
Test site		Guadiana
Purpose of the option		To identify the most productive and efficient irrigation and agricultural management practices in irrigated olive orchards through a Benchmarking procedure
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Procedural method, economic mechanism
Objective of the test		To build a common vision/perspective regarding the irrigated olive production system and identify the most significant impacts and external factors that the activity poses at a multi-scale perspective. To present the Benchmarking results according to the previously developed production system.
How did you manage to test the option?		
Modality or testing	Methods and tools	Frequent farmer visits, experimental evaluation procedures with the farmers (irrigation system evaluation) participatory workshops.
	Level of field implementation (0-5)	4 : A common view of the irrigated olive production system was developed with the farmers; information record sheets were filled by the farmers themselves
	Level of users/stakeholders involvement (0-5)	5: A group of 28 farmers from the CS region accepted to participate in the activity, as well as local cooperatives and a farmers' association.
	Risk of test damage (0-5)	1: The option focused on information collection and farmers' discussion and exchange of perspectives, so no major risk was expected to the farmers' actual practices at this stage.
	External factor consideration	Agricultural activity scheduling prevented the full participation of farmers in the participatory workshops.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	5 : The technical evaluation of irrigated olive plots was fully assessed
	Environmental (0-5)	2 : Environmental impacts should to be assessed in the following years, especially considering water saving, agro-chemical application.
	Economic (0-5)	5 : Individual drip irrigation projects and agricultural practices were monitored and evaluated in order to assess the economic benefits farmers could expect from their activity in order to determine main financial constraints to irrigated olive production.
	Social (0-5)	3 : Collective discussion was performed with the farmers to assess the social impacts of the activity at the personal, farm and regional level
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4 : Highly relevant. Most of the evaluated irrigation systems showed to be poorly designed and lacking specific technical information. This situation often leads to a wrong idea of water consumption as the irrigation systems operate with pressure and discharges not adequate to some system components (drippers, filters) and consequently to crop water needs.
Which are the main positive points		Farmers were able to quantify the production factors and water use in their plots. Most farmers realised that their irrigation system is poorly designed and that there is a highly inefficient water and energy use in olive irrigation.

	Participating actors other than farmers (local agriculture cooperatives, farmer association and a local irrigation research centre) realised that participatory workshops can be used to share ideas and to collect important common perspectives, be an incentive to actor's involvement, and, to some extent, provide training, to farmers and irrigation related actors and stakeholders.
Which are the main negative points?	Due to the olive crop production cycle and the available time span to the case study field implementation, some aspects regarding results dissemination and farmer's involvement were not fully achieved. Farmer participation in participatory workshops was less than expected which could mean that there are still some reserves to the option results.
Which lessons are relevant regarding UE level?	Access to water and buying power prevail as the most significant success factors, namely regarding the access to agro-chemicals and hired labour force. Given the results from the comparative analysis of the Benchmarking activity, some broad guidelines can be used to increase water use efficiency, especially in small and medium sized farmers with limited access to this and other production factors.

Tadla Case Study

Name of the option		Joint irrigation projects
Test site		Tadla
Purpose of the option		To mitigate water stress by organising farmers to collectively modernise their irrigation system
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Integrated innovative technology
Objective of the test		To assess whether the organisation of farmers is relevant regarding the introduction of water saving technologies in order to mitigate water stress and develop smallholder farmers
How did you manage to test the option? (annexe I)		
Modality or testing	Methods and tools	Surveys, farmer to farmer visits, Role-playing games, simulation tools, field implementation
	Level of field implementation (0-5)	5 : The option is tested for real in the field, virtual tests are carried out during the process
	Level of users/stakeholders involvement (0-5)	5: Pilot groups of farmers are involved during all the process, as well as local institutional partners
	Risk of test damage (0-5)	2: Pilot groups of farmers who choose to change their irrigation system take economic risks in case of unsuccessful results. However no risk analysis was pursued
	External factor consideration	State subsidies and water quota in times of drought influenced the process and the results of this test
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site? (annexe II)		
Option evaluation criteria	Technical (0-5)	5 : The technical feasibility of collective projects is deeply assessed
	Environmental (0-5)	2 : Environmental impacts have to be assessed in the following years, especially considering water saving and soil conservation
	Economic (0-5)	4 : Individual and collective drip irrigation projects were studied in order to assess the economic benefits farmers could expect in jointly modernize their irrigation system
	Social (0-5)	5 : Surveys and collective discussion were performed with the farmers to assess the social acceptability of such an option
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4 : The real test lead to the implementation of a joint irrigation project including collective water saving infrastructure as well as the creation of a water user association. Such results are encouraging but some time is necessarily needed to assess the impact of the option in terms of water stress mitigation.
Which are the main positive points		Even though the joint irrigation project is not yet operational, the approach used to support the group in the design of their project (both technical and organisational aspects) has proved to be robust. As a result, the World Bank asked us to use it in training sessions with other farmers of the Tadla scheme. In addition, the water user association which has been created to manage the new infrastructures is a great opportunity to show that farmers can effectively be involved in water management.
Which are the main negative points?		Because the project is led by the farmers themselves, it took longer than planned. All aspects of the option evaluation will thus not be achieved in the AQS project deadline.

Which lessons are relevant regarding UE level?	The modernization of irrigation schemes elsewhere in Morocco and other Mediterranean countries in order to improve water use efficiency by introducing water saving technology could build on the approach designed in this case study. The co-conception of technical projects using participatory methods and tools works and we can believe such approach will ensures the sustainability of the project developed.

Name of the option		Option 3.4.2 Tailoring cropping patterns
Test site		Tadla
Purpose of the option		To reduce irrigation water demand by i) selecting alternative cropping patterns and by ii) shifting the growing period to a period in which one can make a better use of rainfall.
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		procedural method
Objective of the test		1) Investigate the effects of the changed cropping patterns and 2) to provoke discussions on feasible/acceptable cropping patterns / cropping timings for the Tadla region.
How did you manage to test the option? (annexe I)		
Modality or testing	Methods and tools	Scenario approach: formulation of scenarios with stakeholders, agro-hydrological modelling, evaluation of results with stakeholders.
	Level of field implementation (0-5)	0: Virtual testing (modelling) and discussion of results with stakeholders
	Level of users/stakeholders involvement (0-5)	3: alternative cropping patterns are formulated in consultation with stakeholders. The effects of the option is also discussed with stakeholders, after which the modelling continued with refined cropping patterns.
	Risk of test damage (0-5)	0
	External factor consideration	2: interest of farmers for certain crops were taken into account.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site? (annexe II)		
Option evaluation criteria	Technical (0-5)	5 Technical aspects thoroughly assessed
	Environmental (0-5)	2 Environmental aspects partly addressed
	Economic (0-5)	2 economical aspects addressed in terms of crop production (not monetary)
	Social (0-5)	2 social aspects partly addressed (discussion of scenarios with stakeholders to investigate acceptability)
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4 Promising alternative cropping patterns and timings of crops could be established, so that the evaporative demand of crops can be reduced, and a better use of rainfall can be made.
Which are the main positive points		1. Option simulations played a key role in interactions with stakeholders. Demonstrating the quantified effects to stakeholders appeared stimulating to start lively discussions on future trends and possible solutions regarding crops and water use in the area. 2. The option simulation approach with predefined evaluation criteria proved a practical way to bring together the AquaStress research disciplines of the different partners (agro-hydrological, economical and participatory approaches).

Name of the option		Option 3.4.1 Irrigation water management Option 3.1.3 Return flow use Option 3.3.1 Minimizing water losses in agriculture
Test site		Tadla
Purpose of the option		To improve irrigation efficiency.
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Integrated innovative technology, procedural method
Objective of the test		1) investigate the effects of a changed irrigation technology and 2) to provoke discussions on feasible/acceptable water allocation for the Tadla region
How did you manage to test the option? (annexe I)		
Modality or testing	Methods and tools	Scenario approach: formulation of scenarios with stakeholders, agro-hydrological modelling and remote sensing, evaluation of results with stakeholders.
	Level of field implementation (0-5)	0: Virtual testing (modelling) and discussion of results with stakeholders
	Level of users/stakeholders involvement (0-5)	2: The effects of the option were discussed with stakeholders, after which the modelling continued with refined allocation patterns. Stakeholder was trained in the use of remote sensing / hydrological modelling, so that he/she can apply the methods themselves
	Risk of test damage (0-5)	0
	External factor consideration	2: climate change scenario taken into account
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site? (annexe II)		
Option evaluation criteria	Technical (0-5)	5 Technical aspects thoroughly assessed
	Environmental (0-5)	4 Environmental aspects highly addressed (effects to groundwater)
	Economic (0-5)	2 economical aspects addressed in terms of crop production changes
	Social (0-5)	2 social aspects partly addressed (discussion of scenarios with stakeholders to investigate acceptability)
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4 Feasible scenarios were developed and evaluated from an integrated perspective, describing their potential contribution to water saving (water balance aspects), their impact on the environment (stability groundwater table) and their impact on the crop production levels.
Which are the main positive points		The scenarios showed that adding storage facilities (i.e. groundwater aquifers) would improve the Tadla situation, so that water is available for release during drier periods (option “return flow use”). In combination with drip irrigation (option “minimizing water losses”), this adds flexibility to provide better timing of supplies to reduce stress at critical crop growth stages (option “irrigation water management”). This also increases the reliability of water supply.
Which are the main negative points?		The study is a modeling study, no real implementation could be done.
Which lessons are relevant regarding UE level?		The study provides a method and lessons learnt on how to formulate improved scenarios together with stakeholders, and how to evaluate them in an integrated manner: -effects in terms of water saving (water balance aspects), -impact on the environment (stability groundwater table) and -impact on the crop production levels.

	Such approaches are generally valid for other agricultural irrigation areas.

Vecht Case Study

Name of the option		Water systems analysis
Test site		Vecht
Purpose of the option		to understand the fate of water supplied; to estimate if water demand can be met in future climate scenarios
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Integrated innovative technology
Objective of the test		calculate present and future water demand, compare it to the present supply capacity
How did you manage to test the option?		
Modality or testing	Methods and tools	simulation tools
	Level of field implementation (0-5)	0: no field implementation, only model calculations
	Level of users/stakeholders involvement (0-5)	1: the only stakeholder involved is Water Board
	Risk of test damage (0-5)	0: no real world test
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	0
	Environmental (0-5)	1: an important effect of water supply is the decrease in groundwater outflow it causes, thus contributing to the prevention of desiccation of nature areas. However, these effects were not examined in detail
	Economic (0-5)	3: economic effects considered, by using standard relations between groundwater levels and crop yields
	Social (0-5)	0: social effects were not considered
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		3: effects are indirect. The test has helped in developing a better understanding of the water supply system.
Which are the main positive points		one effect has been the realisation that data collection must be improved, together with neighbouring water boards.
Which are the main negative points?		a lot of effort is required for these activities in data collection and getting computer models to run properly
Which lessons are relevant regarding UE level?		under the right conditions (soil type, availability of water) surface water management can make an important contribution to the reduction of groundwater outflow.

Name of the option		Participatory approach in GGOR
Test site		Vecht
Purpose of the option		develop and apply an interactive planning procedure to develop a broadly supported GGOR
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		procedural method
Objective of the test		to improve the quality of the GGOR plan by using interactive methods
How did you manage to test the option?		
Modality or testing	Methods and tools	process design
	Level of field implementation (0-5)	5: field implementation in the planning process
	Level of users/stakeholders involvement (0-5)	5: the option is all about stakeholder involvement
	Risk of test damage (0-5)	3: failure would probably have strong adverse effects and increase antagonies in the region
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	3 : The technical feasibility of collective projects is assessed, though only to the level where they are considered acceptable
	Environmental (0-5)	5: an important driver for the whole process is the prevention of further damage to a Natura2000 area
	Economic (0-5)	3: economic effects are considered implicitly, by stakeholders involved
	Social (0-5)	4: social effects were considered and taken into account by the contributions of the stakeholders
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4: the option has helped to improve the situation re. water stress.
Which are the main positive points		a broadly supported plan was developed, where in the past this process failed
Which are the main negative points?		the final financial commitment has not yet been obtained a critical question could be, if the process has merely led to an acceptable rather than an optimal solution
Which lessons are relevant regarding UE level?		The interactive process has been vital for success.

Name of the option		Hydrological measures for GGOR
Test site		Vecht
Purpose of the option		enable different, closely entwined, land uses to function, by applying hydrological measures
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		integrated innovative technology
Objective of the test		enable different, closely entwined, land uses to function, by applying hydrological measures
How did you manage to test the option? (annexe I)		
Modality or testing	Methods and tools	computer models, discussions with stakeholders
	Level of field implementation (0-5)	0: computer runs
	Level of users/stakeholders involvement (0-5)	5: the results were discussed with stakeholder involvement intensively, until a compromise was reached
	Risk of test damage (0-5)	1: failure would have caused long delays in the process
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site? (annexe II)		
Option evaluation criteria	Technical (0-5)	4 : The technical feasibility of screens and buffer zones is assessed, although not in the best detail imaginable
	Environmental (0-5)	5: an important driver for the whole process is the prevention of further damage to a Natura2000 area
	Economic (0-5)	4: economic effects of the options are considered explicitly as costs; economic effects for stakeholders were considered by their inputs
	Social (0-5)	4: social effects were considered and taken into account by the contributions of the stakeholders
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5: the option developed has been a key factor in the continuation of the process
Which are the main positive points		a broadly supported plan was developed, where in the past this process failed
Which are the main negative points?		costs; a limited number of farmers will have to reallocate
Which lessons are relevant regarding UE level?		

Przemsza Case Study

Name of the option		Support to modernization of the local water supply systems
Test site		Przemsza
Purpose of the option		To give a support to modernization of the local water supply systems which at present are based on “clean” mine waters in view of the foreseen closure of mines
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Procedural method
Objective of the test		- To stimulate local stakeholders to undertake activities for searching for a new drinking water supply system - To build stakeholders’ capability to: · Formulate and solve multicriteria decision problem · Express priorities · Use MCA tools · Be ready to cope with future real tasks of this kind
How did you manage to test the option?		
Modality or testing	Methods and tools	brain - storm panels, practical training with software
	Level of field implementation (0-5)	0 : virtual test with stakeholders
	Level of users/stakeholders involvement (0-5)	5: true stakeholders and decision makers. High interest, some activities were also undertaken by decision makers outside AquaStress to continue the process
	Risk of test damage (0-5)	0
	External factor consideration	the decision makers’ attitude to the problem and its urgency is stimulated by current situation on a zinc market
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	4. The alternative scenarios for future water supply system were valued according to the technical, environmental, economical and social criteria - this is the main feature of multicriteria approach to water management. However in this part of the test was virtual since at the moment there are no real data to fill the real pay-off matrix. This will be possible after completion of numerous field investigations and research (outside AquaStress). Some of them are now being done.
	Environmental (0-5)	
	Economic (0-5)	
	Social (0-5)	
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5. The real test made the decision makers be ready to cope with future real tasks of this kind
Which are the main positive points		Even though the practical training with AquaDT was performed with a virtual pay-off matrix the decision makers learned how to formulate and solve the multicriteria decision problems. The whole decision process was really tested.
Which are the main negative points?		technical troubles with using AquaDT software, it happened that it was unavailable for the planned session
Which lessons are relevant regarding UE level?		Integration of technical, environmental, economical and social aspects in decision process is the main feature of the modern water management and planning. The proposed option gave the opportunity to address this challenge to the true decision makers facing the real serious problem how to supply water to the community of 90000 inhabitants.

Name of the option		Strengthening of public understanding of water stress and building a capacity for the integrated water management
Test site		Przemsza
Purpose of the option		Enable the involvement of all relevant stakeholders and to engage with the public to become partners in the decision making processes related to water management as well as to promote good examples and to build capacity for integrated water management.
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		procedural method
Objective of the test		· involve a range of stakeholders, including local people, throughout the project · develop a collaborative understanding of water stress in the test site and agreement on the key issues · organize a number of short courses dedicated to decision makers and other stakeholder groups; covering capacity-building, empowerment, and education · develop a public awareness-raising campaign and materials for dissemination on key issues in association with local groups
How did you manage to test the option?		
Modality or testing	Methods and tools	workshops, meetings, summer school
	Level of field implementation (0-5)	5 : full true implementation
	Level of users/stakeholders involvement (0-5)	5 : stakeholders and public as main actors
	Risk of test damage (0-5)	1. Some topics seemed to be strange for stakeholders (like gender issues)
	External factor consideration	Every event was prepared with careful attention to the audience invited.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	0
	Environmental (0-5)	5. Environmental issues are strongly connected with water management and were addressed during all events
	Economic (0-5)	2. Economic issues were addressed at the workshop on Decision Support Systems in WM.
	Social (0-5)	5. The events were addressed to stakeholders in general (official meetings like Info Day) but also for some selected groups like students, women and school children,
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4. Raising social awareness for water management problems is a big challenge and in this sphere Poland has still much to do.
Which are the main positive points		To keep involvement of stakeholders in the project activities for the whole project duration was not easy and here we succeeded partially. Much better is with younger generations (students, children). Here we found very willing audience and good material to work with in future.
Which are the main negative points?		It happened sometimes that speakers did not adjust their lectures to the audience and the place they were. Presentation of the same material all over the world might. Some speakers got negative evaluations from participants.

Which lessons are relevant regarding UE level?	On one hand, new regulations, including those related to water management, give people some instruments for being visible and audible partners in the decision making processes but, on the other hand, society is not prepared for making full use of these instruments. The needs for public participation in water management process is clearly stated in WFD.

Name of the option		Improvement of effectiveness of industrial wastewater treatment
Test site		Przemsza
Purpose of the option		To elaborate an integrated system of water management in the industrial catchment
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Integrated innovative technology , Procedural method
Objective of the test		· To identify focal points and ineffective users, · To recommend new technologies adequate for the specific wastewaters, · To introduce suitable monitoring network
How did you manage to test the option?		
Modality or testing	Methods and tools	interviews, modelling, field experiments
	Level of field implementation (0-5)	1 : generally it was a virtual implementation, however the data for modelling and field experiments were real
	Level of users/stakeholders involvement (0-5)	2: stakeholders involved at the level of the case study definition, then as data providers
	Risk of test damage (0-5)	3: in general industrial users are reluctant to open their data bases, it is hard to receive the true picture of their water/wastewater mangement
	External factor consideration	-
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	5. The BREF/BAT references were performed for the local industrial users
	Environmental (0-5)	5. The quality model was elaborated for the whole investigated water course; the recommendations were presented for the monitoring system
	Economic (0-5)	-
	Social (0-5)	-
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4. The institutions involved in water mangemnet are given an approach which when implemented in practice enable to detect “hot spots” and propose necessary mitigation measures. The elaborated quideline is universal and could be applied for any catchment.
Which are the main positive points		The investigated option joins on one floor 2 types of stakeholders: 1.representatives of institutions involved in water management and control (Regional Board for Water Management and Voivodship Inspectorate of Environmental Protection,...); 2.industrial users.
Which are the main negative points?		Competition on a market make industrial users unwilling to open their databases for everyone who asks. Since within AquaStress we were not able to offer any touchable profit like for example new installation, the users lost their interest as not want to be only data providers.
Which lessons are relevant regarding UE level?		Option is strictly based on EU documents, mainly BREF and BAT reports as well as IPPC directive. This is clearly understood by all stakeholders involved.

Name of the option		Support local authorities with legal and administrative capacity to go through conflicts around protection of unique ecosystems in areas of mining activities
Test site		Przemsza
Purpose of the option		To deliver a decision-making enhancement system, for the needs of judicial decisions on water relations in the studied cases. The system should enhance reaching a compromise between the scope of land reclamation and preservation of valuable natural resources deserving to be protected by law.
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		economic mechanism, procedural method
Objective of the test		To make decision makers answer the questions: · what are the benefits for the general public from reducing flood risk, improving biodiversity and improving recreational river access · from which of the above characteristics does the Polish public derive the greatest improvement in welfare? · which are the necessary conditions for economically efficient policy making regarding the management of the aforementioned characteristics
How did you manage to test the option?		
Modality or testing	Methods and tools	questionnaires, field experiments
	Level of field implementation (0-5)	0 : virtual test. Field experiments was planned and performed to gather the data for Choice Experiment Method and Willingness To Pay, but no concrete option was tested for real
	Level of users/stakeholders involvement (0-5)	5 : 192 households were interviewed
	Risk of test damage (0-5)	1: Speaking to ordinary people needs special preparation. Here sociologists are recommended
	External factor consideration	They were considered social, demographic and economic data, including the respondents' age, gender, education, household income and local tax paid by the household, as well as information on whether the household uses the river for recreational activities and flooding episodes that have effected the household in the past decade.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	5. CEM and WTP methods consider environmental, economic and social aspects by their nature. The alternatives presented to respondents were technically feasible.
	Environmental (0-5)	
	Economic (0-5)	
	Social (0-5)	
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5. The results of the CEM and WTP methods gave a ground for making recommendations about technical and legal changes necessary to be made with a view of solving the conflict between flood protection and protection of the unique ecosystems

Which are the main positive points	The true problem was investigated. The wide range of respondents was interviewed. Each interview had to be proceeded by short introduction about AquaStrees which contributes to reaching the dissemination objective.
Which are the main negative points?	Speaking to ordinary people needs special preparation. Here sociologists are recommended.
Which lessons are relevant regarding UE level?	Wide public was involved, not only decision makers but true end users. Through interviews and CEM and WTP methods it was possible to recommend a reasonable (environmentally, economically and socially accepted) strategy for the investigated area;

Flumendosa Case Study

Name of the option		Improvement of agricultural practices to decrease pollutant losses (Option 1 &2)
Test site		Flumendosa
Purpose of the option		Improvement of management of agricultural practice to decrease the discharge of pollutants
Object of test*		Integrated innovative technology
Objective of the test		To determine the extent to which the discharge of pollutants can be decreased by implementing new or adapting existing agricultural practices.
How did you manage to test the option?		
Modality or testing	Methods and tools	SWAT model; stakeholder consultations
	Level of field implementation (0-5)	0: No field implementation carried out.
	Level of users/stakeholders involvement (0-5)	2: Stakeholders were involved throughout the process, actively providing data and contributing to the selection of practices to be included in the tested scenarios to ensure that practical constraints were taken into consideration; end-users were not directly involved.
	Risk of test damage (0-5)	0: No formal risk analysis was carried out but the modality of the test and the lack of field implementation presented no immediate risks to the involved stakeholders or potential end-users.
	External factor consideration	No considerations
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	4: The technical feasibility of implementing new or adapting existing agricultural practices was discussed at great lengths with local stakeholders.
	Environmental (0-5)	4: Environmental impacts, more specifically the potential improvement of water quality was assessed through the SWAT model under different scenarios.
	Economic (0-5)	4: Economic factors were considered in order to estimate the feasibility of each option.
	Social (0-5)	2: New or adapted management practices were selected after lengthy discussions with local stakeholders and thus probably reflect a set of socially acceptable management practices. However, one has to be cautious in assuming that new practices would be approved by local farmers, given that they were not directly involved
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		0 - These Options are not intended to reduce water demand. New or adapted management practices were selected to decrease discharge of pollutants.
Which are the main positive points		Mathematical model can be useful to study and to forecast water demand and water quality.
Which are the main negative points?		Some of adapted management practices selected such as introduction of sunflower can increase water demand, if substituting non-irrigated crops.
Which lessons are relevant regarding UE level?		The results obtained through this work will contribute to our understanding of the interlinkages between river water quality, land use and agricultural practices. The results provide useful insights for river basin planning and management of river basin and particularly the implementation of the WFD.

Name of the option		Water savings in agriculture using alternative cropping patterns (Option 3 &4)
Test site		Flumendosa
Purpose of the option		To mitigate water stress by changing agronomical practices and adapting cropping patterns, both in time and space.
Object of test*		Integrated innovative technology
Objective of the test		1) To assess whether different agronomical practices and specifically cropping patterns help reduce irrigation water demand; 2) To provoke discussions on feasible and acceptable cropping patterns for the Flumendosa region.
How did you manage to test the option?		
Modality or testing	Methods and tools	Combination of the CRIWAR agronomical model, the Hydrosplash regional hydrological model and stakeholder consultations
	Level of field implementation (0-5)	1 Virtual testing (modelling) and discussion of results with stakeholders
	Level of users/stakeholders involvement (0-5)	2: Stakeholders were involved throughout the process, actively providing data and contributing to the selection of crops and cropping patterns to be included in the tested scenarios to ensure that practical constraints were taken into consideration; end-users were not directly involved.
	Risk of test damage (0-5)	0: No formal risk analysis was carried out but the modality of the test and the lack of field implementation presented no immediate risks to the involved stakeholders or potential end-users.
	External factor consideration	2: interest of farmers for certain crops were taken into account.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	4: The technical feasibility of changing crops and cropping patterns was discussed at great lengths with local stakeholders.
	Environmental (0-5)	4: Environmental impacts, more specifically the potential improvement of water quality was assessed through the SWAT model under different scenarios (linked to testing of options 1-2).
	Economic (0-5)	2 Economical aspects addressed in terms of crop production (not monetary)
	Social (0-5)	2: New cropping patterns (spatial and temporal) were selected after lengthy discussions with local stakeholders and thus probably reflect a set of socially acceptable management practices. However, one has to be cautious in assuming that new crops or cropping patterns would be approved by local farmers, given that they were not directly involved
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		3-4: Alternative cropping patterns and improved locations of crops could be established, so that the evaporative demand of crops can be reduced, and a better use of rainfall can be made.
Which are the main positive points		Option simulations played a key role in interactions with stakeholders. Demonstrating the quantified effects to stakeholders appeared stimulating to start discussions on future trends and possible solutions regarding crops and water use in the area.
Which are the main negative points?		- The study is a modelling study, no real implementation could be done. - A study on market conditions and market developments would have been essential to assess the real feasibility / acceptability of implementing the options

	- The integration of the different JWT disciplines was not as much as initially planned. The main reason for this was that different locations for different studies (options) needed to be selected (due to physical aspects, data availability, etc).
Which lessons are relevant regarding UE level?	Guidelines are developed on how crops can better match soil profiles, to make a better use of rainfall. This is in line with contemporary water management approaches in water scarce areas for seeking opportunities to increase infiltration and retention of rainfall in the soil instead of depending on irrigation only.

Name of the option		Optimisation of dam operation as to Vital Minimum Flow (VMF) in the low Flumendosa basin
Test site		Flumendosa
Purpose of the option		To develop dam operation procedures which ensure flow at or above level below which environmental functions of the river cannot be maintained.
Object of test*		Procedural Method
Objective of the test		To develop recommendation of release schedule based on real date of dam operation from the past
How did you manage to test the option?		
Modality or testing	Methods and tools	A model was applied in order to quantify the amount of water needed to maintain Vital Minimum Flow There was now further model application, for example to assess impacts of different operation plans
	Level of field implementation (0-5)	0: The option was not tested.
	Level of users/stakeholders involvement (0-5)	2: The involvement of the main stakeholder ERIS was based on knowledge and data exchange. The stakeholder provided the data needed and consulted the development phase.
	Risk of test damage (0-5)	0: No testing
	External factor consideration	No consideration so far
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	3: Maintenance
	Environmental (0-5)	5: Ecosystem health
	Economic (0-5)	5: Loss of income for farmers due to possible reduction of the allocated water volume
	Social (0-5)	4: Acceptability
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4: As "technical" option this holds a high potential to act as a real water stress mitigation option, as it directly links several water sectors. As "ecological" option it acts as well as mitigation option as ecosystem health and services are supported.
Which are the main positive points		Willingness of stakeholders for cooperation, data delivery by stakeholders, at least the research results in a figure which can be worked with in the future
Which are the main negative points?		Only a starting point, further research for developing a real framework for water stress mitigation would be needed; not enough time; lack of biological and ecological data

Which lessons are relevant regarding EU level?	The key message of the environmental objectives within the WFD is based on a sound and integrated management of environmental quality in river basins which will enable the right choices for society, in particular the setting of ambitious objectives, the consideration of socioeconomic and cost-effective aspects. To evaluate the ecological status of the water bodies, the description of reference conditions is also an important task within the WFD. Achieving this necessitates besides the maintenance of the ecological river quality and that is by providing a minimum flow. Rivers must not dry-up nor have their physical regimes significantly altered in order to conserve the hydrological and ecological functions of their drainage networks. This question must be borne in mind when planning and managing the water resources, especially in semi-arid zones. The determination of environmental/ecological flows for European semi-arid areas is, therefore, of principal relevance. Artificially maintained by reservoir management ecological discharges can be provided by an adapted operation of existing infrastructures.

Cyprus Case Study

Name of the option		Decrease of groundwater overexploitation through the rationalization of the irrigation practices employed (Options 1 and 2)
Test site		Cyprus – Akrotiri aquifer
Purpose of the option		To understand the pressures on the Akrotiri aquifer from agricultural uses in order to define the optimal recharge technique for the aquifer
Object of test*		Integrated innovative technology
Objective of the test		To estimate sustainable withdrawals for domestic and agricultural uses from the Akrotiri aquifer
How did you manage to test the option?		
Modality or testing	Methods and tools	DSS model; scenarios assessed; economic questionaires; stakeholder consultations
	Level of field implementation (0-5)	0: No field implementation carried out.
	Level of users/stakeholders involvement (0-5)	2: Stakeholders were involved throughout the process, actively providing data and contributing to the selection of practices to be included in the tested scenarios to ensure that practical constraints were taken into consideration.
	Risk of test damage (0-5)	0: No formal risk analysis was carried out but the modality of the test and the lack of field implementation presented no immediate risks to the involved stakeholders or potential end-users.
	External factor consideration	0: Other than the strictly technical issues regarding the hydrology, issues such as the policy environment were not considered.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	5: The DSS model's adaptation to the Akrotiri aquifer context was the principal concern.
	Environmental (0-5)	1: The environmental consequences of overextraction due to saline intrusion were recognised but were not the primary drivers.
	Economic (0-5)	5: The economic consequences of a depleted aquifer on agricultural and domestic water supply were the primary concerns behind the model's use.
	Social (0-5)	0: People's discomfort regarding the use of recycled water to articifially recharge the aquifer were not acknowledged in the model.
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5: The DSS model helped to capture the hydrological implications for the Akrotiri aquifer of extraction under different scenarios including the creation of a barrier by artificial recharge.
Which are the main positive points		It was demonstrated that a mathematical model could be used to simulate the aquifer's status under different extraction conditions, which could be linked to agricultural choices through different scenarios and economic decisions.
Which are the main negative points?		The models did not capture farmers' perceptions, and what alternatives they might see to maintain their livelihood.
Which lessons are relevant regarding EU level?		The interlinking of hydrology with farming decisions as driven by economic factors can be useful to see in the context of the Water Framework Directive (WFD) and the Common Agricultural Policy (CAP).

Name of the option		Promote the use of recycled water (Options 3 and 4)
Test site		Cyprus – Akrotiri aquifer
Purpose of the option		To understand Limassol's treatment of wastewater and people's perceptions regarding its use
Object of test*		Integrated innovative technology
Objective of the test		To determine the extent to people are willing to let recycled water be used to recharge the Akrotiri aquifer
How did you manage to test the option?		
Modality or testing	Methods and tools	Summer schools; training workshops; stakeholder consultations; questionaires
	Level of field implementation (0-5)	0: No field implementation carried out.
	Level of users/stakeholders involvement (0-5)	3: Stakeholders were involved through the questionaires and workshops. The summer schools worked with school children to discuss the issue of water scarcity on the island.
	Risk of test damage (0-5)	2: A risk assessment was made of Limassol's wastewater treatment processes.
	External factor consideration	2: People's discomfort regarding recycled water was acknowledged through the consultation processes and the economic questionaires.
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	3: The technical issues surrounding treating wastewater were important in understanding the quality of recycled water being produced.
	Environmental (0-5)	1: The environmental consequences of treating wastewater and reusing it were only tangentially acknowledged.
	Economic (0-5)	3: The economic issues were important to determine farmers' willingness to use recycled water
	Social (0-5)	4: The social acceptability of using recycled water was very important.
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		4: People's discomfort with treated wastewater came through clearly from the workshops, consultations and questionaires.
Which are the main positive points		The options provided a vehicle to capture people's discomfort with recycled water, and showed possible areas that the authorities could address to reassure people.
Which are the main negative points?		The issues raised dealt more with people's perceptions of their situation, and there was not sufficient time to address them. People's willingess to participate in the process is limited.
Which lessons are relevant regarding EU level?		Technology that permits greater efficiencies in water use have social consequences that also need to be addressed if the technology is to have optimal effect.

Iskar Case Study

Name of the option		Saving water in Sofia city
Test site		Iskar
Purpose of the option		To raise awareness among stakeholders and policy-makers about the socio-economic and behavioural constraints and opportunities for reducing household water demand in Sofia city
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Procedural method
Objective of the test		To develop a behavioural model of citizen's perceptions of options for reducing household water demand in the city of Sofia and use it to inform option choice
How did you manage to test the option?		
Modality or testing	Methods and tools	Household surveys
	Level of field implementation (0-5)	0 : Virtual test. Six hundred surveys of citizen's were collected and the results were used to populate a behavioural model and a model of uptake of water saving appliances
	Level of users/stakeholders involvement (0-5)	2: Stakeholders provided input in designing the citizen survey.
	Risk of test damage (0-5)	0: There was no risk of damage from the testing activities
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	5: Technical options included in the citizen survey included: household water saving appliances, pressure-reducing valves on multi-family units, new hot water circulation pumps and vertical pipes.
	Environmental (0-5)	2: Citizens were asked about the main reasons that they would wish to reduce their household water consumption, including 'ecological reasons'
	Economic (0-5)	3: Citizen's were asked a number of questions about their perceptions of the current water price and tariff structure. Willingness to pay for household water saving appliances was used as an indicator of 'intention' in the behavioural model.
	Social (0-5)	5: Results were analysed and compared for different social groups based on income, type of household and number of occupants.
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		2: It was not possible to evaluate the results of the survey with stakeholders. However, as the aim of the social surveys was to raise awareness of issues, and the results of the models provided some interesting insights into citizen's attitudes, the results provide support for their relevance.
Which are the main positive points		Firstly, the social survey results provide evidence that medium and low income families support the use of a block tariff structure, whilst income families were less supportive, possibly due to their higher water use. Secondly, the strongest predictor of uptake of water saving appliances was citizen's 'ability' to install and access such technology, rather than their 'attitude' or 'intention'.
Which are the main negative points?		Even though names and addresses were provided by around 25% of the survey participants, it was not possible to identify household metered water demand records for households and this constrained the analysis. In future the survey sample should be based on serial number of meters collected from the water company and cross-references on the questionnaires.

Which lessons are relevant regarding UE level?	At the EU level, the study broadly recommends the introduction of water efficiency standards on household appliances, particularly in Eastern Accession States where there is currently a very high replacement rate of white goods (toilets, showers, dishwashers, washing machines etc). More research (i.e. water audits) is required into the impacts of high pressure and poorly-maintained infrastructure in communal buildings. If water pricing is to be used as a water conservation measure a number of fundamental conditions need to be understood. Firstly, does the discretionary use (i.e. the water that people can reduce by choice such as some outdoor uses) permit an increase in price to have a significant impact on the water balance? If not price increases will be ineffective, inefficient and inequitable. Secondly, attention needs to be paid to affordability issues by introducing 'lifeline rates' for low-income families to avoid market failure.

Name of the option		Using Bayesian networks to facilitate domestic water conservation implementation
Test site		Iskar
Purpose of the option		To mitigate water stress by providing an interactive computer-based support tool as a forum for dialogue and discussion between researchers, policy makers, engineers and stakeholders
Object of test (Integrated innovative technology, economic mechanism, or procedural method)		Testing decision support tools
Objective of the test		To test the effectiveness of Bayesian networks from an end-user perspective in the context of domestic water conservation
How did you manage to test the option?		
Modality or testing	Methods and tools	Simulation workshop and surveys
	Level of field implementation (0-5)	4 : The option is tested in a simulated environment (testing workshop)
	Level of users/stakeholders involvement (0-5)	5: End-users who tested the tool included: policy-makers from relevant ministries in Sofia, department managers from the Sofia water company, researchers involved in consultation work, and water infrastructure engineers.
	Risk of test damage (0-5)	0: There was no risk of damage from the testing activities
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	5: The technical suitability of the tool in supporting water conservation decisions was tested using performance criteria
	Environmental (0-5)	3: The perceived effectiveness of the tool within different organisational context was analysed. However, the 'virtual' nature of the test meant that it was not possible to directly measure its impact on the water stress situation
	Economic (0-5)	3: A model of the factors affecting the economics of water demand management measures, developed during the field work in Sofia, was used in the testing workshop.
	Social (0-5)	3: Household surveys were collected in the city of Sofia to elicit citizen's attitudes to water conservation. However, it was not possible to use these models during the workshop.
What are the main results of this test regarding water stress mitigation?		

How do you assess the relevance of your option in this context? (0-5)	5: End-user's perceptions of the effectiveness of the Bayesian network tool in providing support for water conservation decisions were elicited using an evaluation instrument following the testing workshop.
Which are the main positive points	There were two statistically significant results of the analysis of end-user's perceived effectiveness scores. Firstly, policy-maker's perceived effectiveness scores were higher (i.e. 6 or higher out of a possible score of 7) than other occupational groups and the results were statistically significant. Secondly, of the seven performance criteria used, overall, end-user's perceived the tool to have performed most effectively (6.39 out of a possible score of 7) in terms of 'transparency' and the results were statistically significant.
Which are the main negative points?	The test relied on quite a small sample size and is a stand-alone test (i.e. it was not repeated) which limits the significance of the results. However, it provides a foundation for future, possibly more extensive studies.
Which lessons are relevant regarding UE level?	The positive scores across all occupational groups, in particular for policy makers, and positive scores for transparency and learning, indicate that Bayesian networks can be an effective tool for facilitating cross-sectoral planning and addressing science-policy interfaces.

Merguellil Case Study

Name of the option		Remote sensing and spatial techniques assessing the agriculture water need and the groundwater use
Test site		Merguellil
Purpose of the option		Improving the management of agricultural water requires a mapping of private and public irrigated areas and a more precise estimate of agricultural water needs
Object of test*		Choice Experiment
Objective of the test		Use of the remote sensing and spatial techniques assessing the agricultural water need and the agricultural groundwater use.
How did you manage to test the option?		
Modality or testing	Methods and tools	Surveys, Multidate and multiresolution remote sensing data interpretation Field Observations and Official Data
	Level of field implementation (0-5)	0: The option allows farmers to have a better understanding of detailed private and public land use and evaluation of water requirements for agriculture
	Level of users/stakeholders involvement (0-5)	3: Local institutional partners as well as farmers have been involved.
	Risk of test damage (0-5)	0: No risk analysis was pursued
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	0 : NA
	Environmental (0-5)	5: If the option is implemented, environmental impacts have to be assessed to monitor the total water use quantity, seasonal distribution and the level of the water table
	Economic (0-5)	5: Individual and collective irrigation projects were studied in order to assess the economic benefits farmers could expect in jointly with best irrigation practices
	Social (0-5)	1: Surveys and collective discussions were performed with the stakeholders to have some field observations.
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5 : The use of remote sensing leads to the delimitation of the private irrigated areas and the identification of their detailed land use. It can be used to evaluate water volumes pumped from the aquifer and better predict the total water requirements for agriculture use in the region.
Which are the main positive points		Maps of water requirements for agriculture provide a reference for local institutional partners as well as farmers to the management of agricultural water.
Which are the main negative points?		Data update and the spread of the information.
Which lessons are relevant regarding UE level?		This study provides reference for the stakeholders to estimate agriculture water needs to allow a better agriculture water management.

Name of the option		Fostering gender aspects of water management in the Merguellil catchment (Tunisia)
Test site		Merguellil
Purpose of the option		This initiative intends to build the social awareness about women's role in irrigated agriculture as well as to foster the women integration in decision making processes of land and water management.
Object of test*		Choice Experiment / Training of trainers on Gender Aspects
Objective of the test		This activity aims to promote behaviour changes in the Merguellil catchment (Tunisia), leading to a more equitable distribution of responsibilities and benefits of sustainable management of land and water resources.
How did you manage to test the option?		
Modality or testing	Methods and tools	Participatory approach and a socio-economic survey and completed by a training course for rural trainers.
	Level of field implementation (0-5)	0: The option is a virtual test that allows integrating gender aspects in water management, enhancing the stakeholders involvement, strengthening the public understanding of water shortage problems and improving the efficiency of water use.
	Level of users/stakeholders involvement (0-5)	5: Local institutional partners as well as farmers have been involved.
	Risk of test damage (0-5)	0: No risk analysis was pursued
	External factor consideration	
What is the relative importance between the different evaluation criteria you used to assess the relevance of the proposed option in the test site?		
Option evaluation criteria	Technical (0-5)	0 : NA
	Environmental (0-5)	0: NA
	Economic (0-5)	4: improving the efficiency of water use by Integrating gender aspects in water management.
	Social (0-5)	5: Surveys and collective discussion were performed with the farmers to assess the social acceptability of such an option
What are the main results of this test regarding water stress mitigation?		
How do you assess the relevance of your option in this context? (0-5)		5: This test will contribute to strengthen the participatory approach and the social aspects of integrated water management in Tunisian test site.
Which are the main positive points		Analyse the actual gender situation and establish a dialogue among all interested stakeholders for a sustainable and equitable development of agricultural sector including Gender Aspects.
Which are the main negative points?		none
Which lessons are relevant regarding UE level?		This study takes into consideration the following main themes: • Social and institutional dimensions of gender issues and woman role in water management; • Participatory approach and integrated water management; • Role of woman in the agricultural sector and water saving.